

General Specifications

GS 25G10A01-01EN

Model HXS10
Application Specific Controller
Model HXSS10
Setting Software for HXS10

SolStation™

[HXS10 Application Specific Controller]

GENERAL

The HXS10 is a general-purpose controller with a function to calculate solar position for the new energy market.

- Up to 6 analog and 12 digital inputs, and up to 2 analog and 12 digital outputs are available
- Up to 2 pulse counter (encoder) inputs are available
- Ethernet, RS-232, and RS-485 communication options are available
- Control function allows for creating internal calculations to support various applications
- Two proven programming methods of the YS series, function block programming and text programming, are available
- Sophisticated PID calculation functions of the YS series are available

FEATURES

• User Programming Function

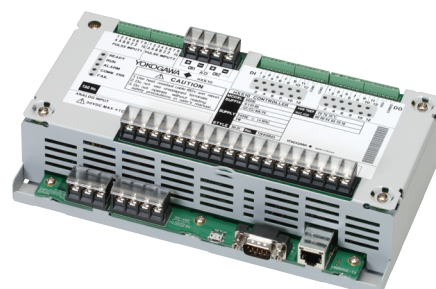
The user programming function allows for performing calculations for analog, digital, and pulse counter input values, or values from communication, as well as internal parameter values, and storing the results as analog, digital, and communication output values, or as internal parameters.

The use of HXSS10 Setting Software for PC allows for creating calculations.

Two programming methods, function block programming and text programming, are available. The following basic calculations can be used with the following computation modules.

Computation Module List

	Module Name	Max. number of times of use (*1)
Basic Computations	Addition	Unlimited
	Subtraction	
	Multiplication	
	Division	
	Square root extraction (no hysteresis)	
	Absolute value	
	High selector	
	Low selector	
	High limiter	
	Low limiter	
	Natural logarithm	
	Common logarithm	
	Exponential	
	Power	
	Temperature compensation	
	Pressure compensation	
	Scaling	
	Normalization	
	Ratio	
	Conversion from DI to BCD	



Computation Modules with Serial Number	Conversion from BCD to DO	
	Conversion from DI to binary	
	Conversion from binary to DO	
	Maximum	
	Minimum	
	Average	
	Increment	
	Decrement	
	trigonometric function	
	Bit operation	
	10-segment linearizer function	Unlimited
	Inverse conversion of 10-segment linearizer function	Unlimited
	Arbitrary segment linearizer function	Unlimited
	Inverse conversion of arbitrary segment linearizer function	Unlimited
	Segment linearizer bias	Unlimited
	High limit alarm	8
	Low limit alarm	8
	First-order lag (2 kinds: second, minute)	8 each
	Derivative (2 kinds: second, minute)	2 each
	Dead time (2 kinds: second, minute)	3 each
	Velocity computation (2 kinds: second, minute)	3 each
	Moving average computation (2 kinds: second, minute)	3 each
	Velocity limiter	6
	Timer (2 kinds: second, minute)	16 each
	Time out (2 kinds: second, minute)	16 each
	Hold timer (2 kinds: second, minute)	16 each
	Delay timer (2 kinds: second, minute)	16 each
	Change detection	32 x 3
	Square root extraction (Low cutoff point or less: Linear) (*2)	8
	Square root extraction (Low cutoff point or less: Zero) (*2)	8
	RS flip-flop	32
	Previous input variable	16
	Hold	16
	Logical Operations	Unlimited
	AND	
	OR	
	Exclusive OR	
	NOT	Unlimited
	Conditional Judgement	
	Comparison	
	Comparison of time	
	Signal switching	
	Jump (*3)	2
	Conditional jump (*3)	
	Jump to sub-program	
	Basic control	
	Control Functions	Unlimited
	Others	
	S register change (*3)	Unlimited
	S register rotation (*3)	

*1: Limitation when used within the limit of programming capacity. There is the maximum number of times of use for modules that use buffers such as that for the previous value.

*2: Hysteresis exists at low cutoff point.

*3: Unavailable in function block programming.

Handling of Input/Output Signals

The user programming uses 32-bit floating-point operations.

Inputs/Outputs from Terminals

Analog input (AI)	0 to 100% input in the analog input range (RLn to RHn) is stored in Xn (n = 1 to 6) as a floating-point number from 0.0 to 1.0.
Analog output (AO)	Storing a floating-point number from 0.0 to 1.0 in Yn (n = 1 to 2) outputs an analog signal in the range from 0 to 100%.
Digital input (DI)	17 V or more voltage input or closed contact is stored in DIn (n = 1 to 12) as a floating-point number 1.0. 4 V or less voltage input or open contact is stored in DIn (n = 1 to 12) as a floating-point number 0.0.
Digital output (DO)	Storing 0.5 or more in DOn (n = 1 to 12) closes the contact and storing less than 0.5 opens the contact.
Pulse counter (encoder) input	Value converted from the count value range (EnZCNT to EnSCNT) to the angle range (EnZANG to EnSANG) is stored in En (n = 1 to 2).

Xn, DIn, and En are updated in the stop state. For Yn and DOn, the last state is held

Inputs/Outputs from Communication

CX and CY are holding registers for MODBUS, which hold 32-bit integer numbers or 32-bit floating-point numbers. Additionally, there are decimal point position parameters CXD and CYD for handling integer numbers. Floating-point numbers are used in the user programming.

	When the HXS10 is a communication master/client	When the HXS10 is a communication slave/server
Numerical input CXn (n = 1 to 250)	Set the following using the PC software HXSS10. • Register no. of the target Slave/Server • Data format of the target Slave/Server • Register no. of CXn which stores the read value	You can write to / read from CXn an arbitrary value via external communication.
Numerical output CYn (n = 1 to 250)	Set the following using the PC software HXSS10. • Register no. of the target Slave/Server • Data format of the target Slave/Server • Register no. of CYn which stores the value to write	You can read from CYn a value via external communication.

Parameters Available in User Programming

- All parameters for control calculations
- All parameters for solar position calculations
- Input/output registers CX and CY from communication, with the exception of scaling parameters.

General-purpose Parameters (Registers) for User Programming:

	Operations available for the user programming	Operations available for communication (when the HXS10 is a slave/server)	Saving to nonvolatile memory
P parameters (P01 to P200)	• LD (read)/ST (write)	• Read/write • Scaling	• Saved
K constants (K01 to K200)	• LD (read) only	• Read/write (can be performed only from HXSS10 Setting Software for PC)	• Saved
T registers (T01 to T200)	• LD (read)/ST (write)	• Read (can be performed only from HXSS10 Setting Software for PC)	• Not saved

Calculation Period

	In the case of no AI or 2 AIs	In the case of 4 or 6 AIs
Calculation Period	100 ms/250 ms	250 ms

User Program Capacity

Refers to the capacity of data that can be described in user programs, including main programs and sub-programs. Sub-programs can be used repeatedly.

Programming method	Capacity of data that can be described in user programs
Text programming	Up to 1,000 steps
Function block programming	Up to 400 modules when "Application" in Model and Suffix Codes is -01. Up to 1200 modules when "Application" in Model and Suffix Codes is -02.

User Program Executable Capacity

A user program must be completed within the calculation period.

The execution time of the computation modules used in the user program varies from one to another. Accordingly, the number of steps or modules that can be executed within the calculation period varies depending on the user program.

The ratio of the user program's execution time within the calculation period can be checked by the load factor parameter.

The load factor should be set to 100% or less. A load factor of more than 100% causes an alarm. A load factor exceeding 200% forcibly stops the user program.

("Denominator of the load factor") =

((("Calculation period") – ("time for input/output, communication, and solar position calculation"))

Debugging Monitoring Function

The use of HXSS10 Setting Software for PC allows for checking the program online.

A test run function and online module monitoring function are available.

Solar Position Calculation Function

This function calculates the estimated solar position based on the latitude, longitude, current date and time, or the like, using the Solar Position Algorithm (SPA).

The solar position calculation uses the algorithm and software of the National Renewable Energy Laboratory of the United States Department of Energy.

Parameters necessary for the solar position calculation include the current time, calculation time offset in seconds (to estimate the position a few seconds later), difference from the atomic clock, and the latitude, longitude, altitude, time zone, annual average temperature, annual average atmospheric pressure, and air reflection coefficient of the installation location.

The calculation results include azimuth angle, zenith angle, solar angle for the trough mirror/north-south axis tracker, sunrise time, culmination time, and sunset time. The calculation results are stored in parameters and can be referred to in the user program.

Every time the second hand for the current time moves forward, the solar position calculation starts, regardless of the calculation period.

Control Calculation Functions

Control Computation Module

The combined use of the control module and each of the computation modules allows for creating control calculations. The following shows control computation modules. One BSC1 and one BSC2 can be used in the same program.

Basic control modules (BSC1 and BSC2)

Control Types

The control type can be selected by a parameter from standard PID control and proportional derivative (PD) control.

Control Parameters

Common Parameters for PID and PD Control

	PID control
Proportional band (PB)	0.1 to 999.9 (sec.)
Integral time (TI) (*1)	1 to 9999 (sec.)
Derivative time (TD) (*2)	0 to 9999 (sec.)

Parameters Specific to PD Control

	PD Control
First-order lag time constant *3	1 to 9999 (sec.)
Manual reset	–6.3 to 106.3 (%)

*1: Needs no setting for PD control.

*2: A setting from 1 to 9999 is effective and 0 means OFF.

*3: To avoid abrupt changes in output when the operation mode is changed, follow-up actions take place with first-order lag delay. Set the parameter to an integral time.

Control Calculation Method

The control calculation method can be selected by a parameter from proportional preceding PID and derivative preceding PID.

When proportional control is selected for the control type, derivative preceding PID must be selected.

Control Add-on Functions

The actions of the control computation module can be defined in detail by parameter settings.

PID control with reset bias
Output limiters
Alarm detection (HHL, HL, LL, LLL, measurement value change rate, deviation)
Cascade setting input
Preset PID

Alarms detected in the control calculation module are stored in each parameter.

The user can set the parameter to OR in the user program and store it in the ALARM lamp register, if necessary.

Finally, the value stored in the ALARM lamp register and the abnormal state detected by the HXS10 are set to OR to set the ALARM LED to the ON state.

• Power Failure and Recovery, and RUN and STOP

A power failure sets the analog output to 0 mA and opens the digital output.

Power on sets the RUN and STOP mode to RUN.

The user program allows for checking the first-time-after-power-on flag (parameter PON).

HOT Start and COLD Start

HOT start	The state at the time of a power failure is backed up and that value is used to continue operation.
	The following is backed up
	• AO value
	• Control mode (C, A, and M)
	• Buffers, such as that for the previous value of the computation module with user program serial number
COLD start	Always starts operation in the same state, regardless of the state at the time of a power failure.
	• AO starts from –25% (however, the output LL from the output terminal is 0 mA.)
	• Starting control mode is M.
	• The previous value of the computation module with user program serial number is initialized to zero or the current value in the first calculation period.

RUN and STOP

RUN	• RUN is a state in which the user program is executed.
STOP	• The user program is not running.
	• The input, clock, solar position calculation, and communication are operable, which means Xn, DI _n , and the like are updated.
• Switching STOP to RUN outputs the previous value. Other than that, the output remains the same as with the COLD start.	

Data Types and backed up

Data	With or without backup	Initial values at the time of COLD start
X, DI	Without backup	0.0, 0 (open)
Y, DO	With backup at every calculation period	-25.0%, 0 (open)
CX	Without backup	0
CY	Without backup	0
P	With backup every time changed	Backup value
K	With backup every time changed	Backup value
T	With backup at every calculation period	0
Control parameter	With backup every time changed	Backup value
Control's internal register	With backup every time changed	Backup value
Previous value of the computation module with user program serial number, etc.	With backup	Varies depending on the module.
Date/time	With backup	Current time (also applies to the HOT start)
Solar position calculation result	Without backup	Undefined until the calculation result valid flag is set (also applies to the HOT start)
Each alarm	With backup at every calculation period	Alarm OFF
E	With backup at every calculation period	Backup value

• Self Diagnosis

Diagnostic Result	Cause	Remarks
FAIL	•Main CPU failure •A/D converter problem •Memory error	At Fail, both DO12 and FAIL indicators are activated.
ALARM	•Control period exceeded •Computation overflow •User program error	

• Security Functions

Security functions available in HXSS10

• Users can set password on an user defined program from the PC software HXSS10.
• When a password is not set in an user program, you can upload / download the program from the PC software HXSS10.
• When a password is set in an user program, HXSS10 software ask you to type in password prior to upload / download. Once the password matches, you can upload / download the program from the PC software HXSS10.
• There is a password lock function for output files (with the extension .hss) of HXSS10 Setting Software for PC.

Communication Security Function

•Modbus/TCP can be set to reject access from any address other than specified IP addresses (up to 10).
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• Communication Functions

The following describes the standard communication between the HXS10 and other devices, such as a PC, PLC, and DCS.

Type	Modbus/TCP		Modbus (RTU)	
Method	Server	Client	Master	Slave
Interface	• Ethernet		• RS-485 • RS-232	
Connected devices	• External devices, such as a PC • Inter-HXS10			
Maximum number of connected devices	4 (connection)	10	31	1
Communication data	Measured value, setpoint, output value, and alarm			

* Client/Master Specifications

Communication period: 100 ms, 250 ms, 500 ms, 1 sec, 2 sec, 5 sec (not synchronized to the control calculation period)

Modbus master can issue up to 200 commands for both RS232 and RS485 combined.

Modbus client can issue up to 200 commands.

The data types accessible through Modbus are the following. 16-bit integer, 32-bit integer, 32-bit floating-point, and bit (coil and DI).

SNTP Client Function

This function checks the time with the specified SNTP server and synchronizes the time.

Specifiable number of servers	1
Check period	Can be selected from 3, 6, 12, or 24 hours
Reference time	The reference time to be checked can be set
Timeout time	Can be selected from 1 to 60 sec

SNTP Server Function

Runs the HXS10 as a SNTP server.

Port number	123 (factory initial value). The value can be changed by the user.
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• Clock Function

With calendar function (AD)

Clock accuracy	±100 ppm (in the entire temperature range)
Time setting	• Set from HXS10 • Set from an upper-level device (write to the register) • SNTP client function
Clock adjustment method using SNTP	When an user program is running, time adjustment with the SNTP server will not be executed if deviation is 10 minutes or more. When an user program is stopped, time synchronization is executed regardless of the deviation.
Time zone	Setting of time difference from Greenwich Mean Time: -18.00 to 18.00 (can be set in minute increments)
Time range	January 1, 2001, to December 31, 2037
Summertime	Available

• Display Functions

Instrument status display

The instrument status is indicated using LEDs as follows:

LED Name	LED Color	ON	OFF
READY	Green	Normal condition	Failure (*1) / Power OFF
RUN	Green	Under operation	Stopped condition (*2)
ALARM	Yellow	Alarm is detected	No Alarm
COMM ERR	Yellow	Communication error detected (*3)	Communication is functioning
FAIL	Red	FAIL detected (*4)	No FAIL

*1: The unit is not functioning properly. (e.g. due to power supply failure)

*2: The HX-S is being configured by the PC software. During the test run mode (running the simulation program), the LED blinks.

*3: Communication error: Blinking (when an error occurred in Modbus or SNTP.)

*4: Refer to the Self Diagnosis Feature

Digital input (DI)/digital output (DO) status display

The status of ON/OFF of each DIO can be displayed by the corresponding LED.

LED Name	LED Color	Lit	Unlit	Remarks
DI1 to DI12	Red	ON	OFF	
DO1 to DO11	Red	ON	OFF	ON: CLOSE
DO12	Red	ON (*1)	OFF	OFF: OPEN

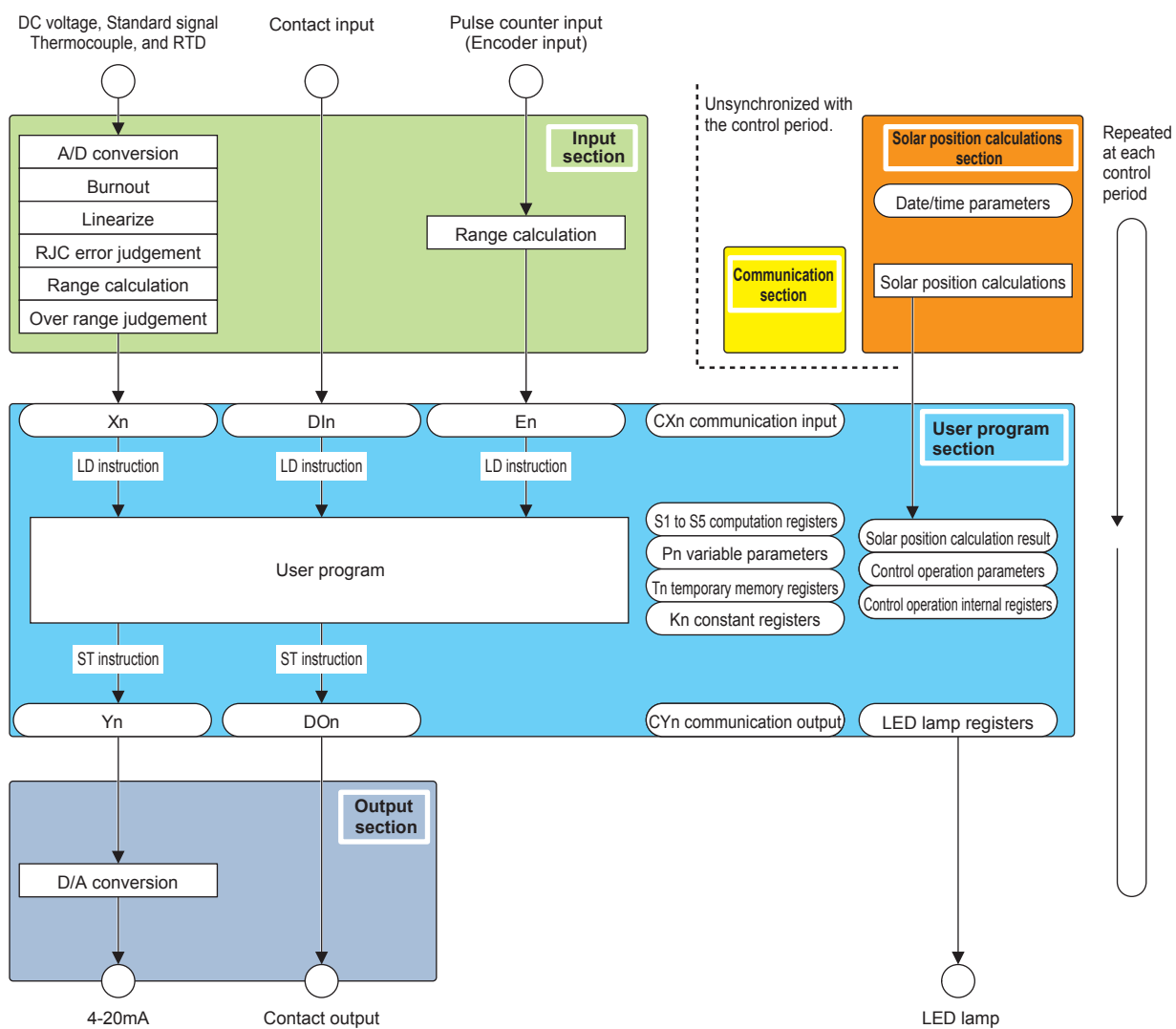
*1 At Fail, both DO12 and FAIL indicators are activated.

• Setting Function

HXSS10 Setting Software running on a PC is used to set parameters and create programs.

Connection method	• HXSS90 Proprietary cable for HXS10 • Ethernet
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FUNCTION BLOCK DIAGRAM



HARDWARE SPECIFICATIONS

• Input/Output Specifications

Analog Input (AI)

- Number of Universal Inputs: Max. 6 (M3 screw terminal)
- Input range: -5% to 105% (The guaranteed accuracy range is 0% to 100%.)
- Input type, instrument range, and measurement accuracy: See the table below,

Input Type		Range name (Range code)	Measurable range		Accuracy
DC voltage	20 mV	20 mV (0)	-20.000 to 20.000 mV		±0.05% of instrument range ±1 µV
	60 mV	60 mV (1)	-60.00 to 60.00 mV		±0.05% of instrument range ±10 µV
	200 mV	200 mV (2)	-200.00 to 200.00 mV		
	1 V	1 V (3)	-1.0000 to 1.0000 V		±0.05% of instrument range ±0.1 mV
	2 V	2 V (4)	-2.0000 to 2.0000 V		
	6 V	6 V (5)	-6.000 to 6.000 V		±0.05% of instrument range ±1 mV
	0-10 V	0-10 V (6)	0.000 to 10.000 V		±0.1% of instrument range ±1 mV
	20 V	20 V (7)	-20.000 to 20.000 V		±0.05% of instrument range ±1 mV
Standard signal	0.4-2 V	0.4-2 V (8)	0.4000 to 2.0000 V		±0.1% of instrument range ±0.1 mV
	1-5 V	1-5 (9)	1.000 to 5.000 V		±0.1% of instrument range ±1 mV
Thermocouple (*1)	K	K1 (10)	-270.0 to 370.0°C	-450.0 to 2500.0°F	± 0.1% of instrument range ± 0.1°C for 0°C or more
		K2 (11)	-200.0 to 500.0°C	-200.0 to 1000.0°F	± 0.2% of instrument range ± 0.1°C for less than 0°C
	J	J (12)	-200.0 to 1100.0°C	-300.0 to 2000.0°F	± 2% of instrument range ± 0.1°C for less than -200°C of thermocouple K, T.
	T	T (13)	-270.0 to 400.0°C	-450.0 to 750.0°F	
	B	B (14)	0.0 to 1800.0°C	32 to 3300°F	± 0.15% of instrument range ± 0.1°C for 400°C or more ± 5% of instrument range ± 0.1°C for less than 400°C
	S	S (15)	0.0 to 1700.0°C	32 to 3100°F	± 0.15% of instrument range ± 0.1°C
	R	R (16)	0.0 to 1700.0°C	32 to 3100°F	
	N	N (17)	-200.0 to 1300.0°C	-300.0 to 2400.0°F	± 0.1% of instrument range ± 0.1°C for 0°C or more ± 0.25% of instrument range ± 0.1°C for less than 0°C
	E	E (18)	-270.0 to 800.0°C	-450.0 to 1450.0°F	± 0.1% of instrument range ± 0.1°C for 0°C or more
	L	L (19)	-200.0 to 900.0°C	-300.0 to 1600.0°F	± 0.2% of instrument range ± 0.1°C for less than 0°C
	U	U (20)	-200.0 to 400.0°C	-300.0 to 750.0°F	± 1.5% of instrument range ± 0.1°C for less than -200°C of thermocouple E.
	W	W (21)	0.0 to 2300.0°C	32 to 4200°F	± 0.2% of instrument range ± 0.1°C
	Platinel 2	PL2 (22)	0.0 to 1390.0°C	32.0 to 2500.0°F	± 0.1% of instrument range ± 0.1°C
	PR20-40	P2040 (23)	0.0 to 1900.0°C	32 to 3400°F	± 0.5% of instrument range ± 0.1°C for 800°C or more Accuracy is not guaranteed for less than 800°C
	W97Re3-W75Re25	WRe (24)	0.0 to 2000.0°C	32 to 3600°F	± 0.2% of instrument range ± 0.1°C
RTD	JPt100	JPT1 (25)	-200.0 to 500.0°C	-300.0 to 1000.0°F	± 0.1% of instrument range ± 0.1°C (*2)
		JPT2 (26)	-150.00 to 150.00°C	-200.0 to 300.0°F	± 0.1% of instrument range ± 0.1°C
	Pt100	PT1 (27)	-200.0 to 850.0°C	-300.0 to 1560.0°F	± 0.1% of instrument range ± 0.1°C (*2)
		PT2 (28)	-150.00 to 150.00°C	-200.0 to 300.0°F	± 0.1% of instrument range ± 0.1°C

K, J, T, B, S, R, N, E: IEC584-1 (1995) DIN IEC584 JIS C1602-1995

U: Cu-CuNi, DIN43710, L: Fe-CuNi, DIN43710

W: W-5% Re/W-26% Re (Hoskins Mfg. Co.), ASTM E988

W97Re3-W75Re25: W-3% Re/W-25% Re (Hoskins Mfg. Co.)

Pt100: JIS C1604-1997 IEC751-1995 DIN IEC751-1996

JPt100: JIS C1604-1989 JIS C1606-1989 Measuring current $i=1$ mA

- The accuracy is that in the standard operating conditions: 23±2°C, 55±10%RH, and power voltage at 24 VDC ±10%.

*1: Excluding reference junction compensation errors.

*2: ±0.4°C in the range between 0 and +100°C, ±0.6°C in the range between -100 to +200°C, ±0.8°C in the range between +200 to +500°C

Input sampling period	Synchronous with control period 100 ms or 250 ms (Analog Input 2 channels) 250 ms (Analog Input 4 channels or 6 channels)	
Burnout detection	• Functions at TC, RTD, and standard signal. • Detection ON/OFF switchable (settable for each channel) • Upscale, downscale, and off can be specified. • If "OFF" is specified, analog input value is undefined. • For standard signal, burnout is determined to have occurred if it is less than 0.1 V. • Detection time (max): 2 sec.	
Input bias current	10 nA or less (except the case of setting burnout detection)	
Measured current (RTD)	About 1 mA	
Input resistance	10 M Ω or more (for TC / DC voltage (1 V range or less)) About 1 M Ω (for DC voltage (2 V range or more) / standard signal)	
Allowable signal source resistance (Thermocouple, DC voltage and Standard signal)	2 k Ω or less	
	Effects of signal source resistance	$\pm 10 \mu\text{V}/1 \text{ k}\Omega$ or less (for TC / DC voltage (1 V range or less)) $\pm 0.15\%/1 \text{ k}\Omega$ or less (for DC voltage (2 V range or more) / standard signal)
Allowable wiring resistance (RTD)	Max. 10 Ω /wire (The conductor resistance between three wires shall be equal.)	
	Wiring resistance effect: $\pm 0.1^\circ\text{C}/10 \Omega$ (The conductor resistance between three wires shall be equal.)	
	The variation due to a difference in resistance between conductors, 40 m Ω (maximum difference between three wires), is approx. 0.1°C .	
Allowable input voltage	$\pm 10 \text{ V}$ DC (for TC / DC voltage (1 V range or less) / RTD input) $\pm 30 \text{ V}$ DC (for DC voltage (2 V range or more) / standard signal)	
Noise rejection ratio (*1)	40 dB or more (at 50/60 Hz) (Normal mode)	
	120 dB or more (at 50/60 Hz) (Common mode)	
Maximum common mode noise voltage	250 V ACrms or less	
Maximum inter-channel noise voltage	250 V ACrms or less	
Reference junction compensation error	$\pm 1.5^\circ\text{C}$ (15 to 35°C)	
	$\pm 2.0^\circ\text{C}$ (-10 to 15°C and 35 to 50°C)	
	$\pm 2.5^\circ\text{C}$ (-20 to -10°C and 50 to 70°C)	
Effect of ambient temperature	$\pm 0.01\%$ of instrument range / $^\circ\text{C}$	
External connection	M3 screw terminal (tightening torque: 0.6 N·m) Applicable wires:AWG26 to AWG18	

*1: With digital filter set

Analog Output (AO) (optional code /AA)

Number of outputs	2 (M3 screw terminal)
Output type	Current output: 4 to 20 mA DC or 0 to 20 mA DC
Load resistance	600 Ω or less
Output accuracy	$\pm 0.1\%$ of span ($\pm 5\%$ of span for 1 mA or less) The accuracy is that in the standard operating conditions: $23 \pm 2^\circ\text{C}$, $55 \pm 10\% \text{RH}$.
Effect of ambient temperature	$\pm 0.02\%$ of F.S./ $^\circ\text{C}$ or less
External connection	M3 screw terminal (tightening torque: 0.6 N·m) Applicable wires:AWG26 to AWG18

Step Response Time

Step Response Time	Within 500 ms (for computation period 100 ms) (63% of analog output response time when a step change of 10 to 90% of input span is applied)
	Within 1.5 s (for computation period 250 ms) (63% of analog output response time when a step change of 10 to 90% of input span is applied)

Digital Input (DI)

Number of inputs		12	
Input type		DC voltage input (used for sink and source), open collector or no-voltage contact input (External DI-driven power supply)	
Insulating		Photo-coupler isolation (internal circuit – input)	
Rated current (input)		About 1.4 mA /1 digital input	
Rated input voltage		24 V DC	
Input voltage		20.4 to 26.4 V DC	
Input resistance		About 16.5 kΩ	
ON/OFF detection	Voltage input	On-voltage / On-current	17 V DC or more / 1 mA or more
		Off-voltage / Off-current	4 V DC or less / 250 μA or less
	Open collector input	Input voltage of 2 V DC or less is determined as “ON” and leakage current must not exceed 250 μA when “OFF.”	
	No-voltage contact input	Contact resistance of 1 kΩ or less is determined as “ON” and contact resistance of 100 kΩ or more as “OFF.”	
External connection		2.54 mm-pitch clamp terminal (recommended tightening torque: 0.12 – 0.15 N·m) Applicable wires: 0.14 to 0.5 mm ² (AWG26 to AWG20) Stripped wire length: 4.5 mm	

Pulse counter Input (Encoder Input) (optional code /PC)

Number of channels	2 channels
Input pulse method	Incremental encoder
Input pulse rate	10000 (pulse/s) (phase A/phase B (single multiplication)) 20000 (pulse/s) (phase A/phase B (double multiplication)) 40000 (pulse/s) (phase A/phase B (quad multiplication))
Corresponding encoder output	Complementary output (push/pull) / Differential output
Rated input voltage	24 V±20% (19.2 to 28.8 V : operating voltage range)
Rated input current	5 mA or less
On-voltage / On-current	14 V DC or more / 1.6 mA or more
Off-voltage / Off-current	2 V DC or less / 0.25 mA or less
External connection	2.54 mm-pitch clamp terminal (recommended tightening torque: 0.12 – 0.15 N·m) Applicable wires: 0.14 to 0.5 mm ² (AWG26 to AWG20) Stripped wire length: 4.5 mm

Digital Output (DO)

Number of outputs	12 (Note : DO12 is used for DO12 and FAIL output.)
Output type	Transistor contact output (SINK: Share a common wire with the external power supply)
Isolation method	Photo-coupler isolation (internal circuit – input)
Rated load voltage	Lower than the external power supply voltage
Maximum load current	100 mA / one DO
On-voltage	0.6 V DC or less
Leakage current at OFF	0.1 mA or less
External power supply	12 to 24 V DC (10.2 to 26.4V DC) 20 mA or more
External connection	2.54 mm-pitch clamp terminal (recommended tightening torque: 0.12 – 0.15 N·m) Applicable wires: 0.14 to 0.5 mm ² (AWG26 to AWG20) Stripped wire length: 4.5 mm

• Communication Specifications

Ethernet Communication

Communication standard	compliant with IEEE 802.3
Transmission type	10 BASE-T / 100 BASE-TX
Rate	10/100 Mbps (automatic)
Connector type	RJ-45
Segment	100 m max
Protocol	Modbus/TCP client, Modbus/TCP server, SNTP client and SNTP server

Serial Communication (RS-232/RS-485)

Address setting (Setting Range)	1 to 247 (RS-485) , fixed 1 (RS-232) (Use the setting software)
Rate	1200/2400/4800/9600/19200/38400/57600/115200 bps
Communication method	Asynchronous communication method
Data length	8 bit
Start bit	1 bit
Stop bit	1 bit/2 bits
Parity	ODD/EVEN/NONE
Protocol	Modbus RTU master or Modbus RTU slave

RS-232 (optional code /C2)

Network topology	1:1
Modes of operation	full-duplex
Hardware handshaking	none
Connector type	DSUB-9pin
Maximum distance	max. 15 m

RS-485 (optional code /C3)

Network Topology	1:n multidrop, max. n=31
Modes of operation	Half-duplex by using two wires
Maximum distance	1.2 km max
Terminating resistors	External (220 Ω , 1/4 W or more)
External connection	M3 screw terminal (tightening torque: 0.6 N·m) Applicable wires:AWG26 to AWG18

Maintenance communication

Using the PC software, configuration parameter data, programming, F/W download can be realized through this port.

Number of ports	1
Connector	Micro-USB (Micro-B)
Cable	USB-TTL conversion cable (HXSS90)
Interface	Compliant with USB1.1
Supported Driver OS	Windows XP Professional (Service Pack2 or later) (32 bit version) Windows Vista Business (Service Pack1 or later) (32 bit version) Windows 7 Professional (32 bit version)

• Power Supply Specifications and Isolation

Power Supply Specifications

Rated voltage	24 V DC±10%
Power consumption	5 W or less
Power holdup time	1 ms or less

Isolation

•Withstanding voltage

Among AI input channels	1000 V AC for 1 minute
Between analog input and internal circuits	1500 V AC for 1 minute
Between analog input and external circuits	1500 V AC for 1 minute
Between power supply and other circuits	1500 V AC for 1 minute
Between internal and external circuits	1000 V AC for 1 minute
Among other circuits	1000 V AC for 1 minute

Internal circuits	Power supply (24 V DC)	Analog Input 1	
	•RS232 communication •Maintenance communication •FG terminal	Analog Input 2	
		Analog Input 3	
		Analog Input 4	
		Analog Input 5	
		Analog Input 6	
		External circuits	Analog Output 1
			Analog Output 2
			Digital Input 1 to 12
			External power supply
			Digital Output 1 to 12
			External power supply
			RS485 communication (Except FG terminal)
			Pulse Counter Input 1 (Except FG terminal)
			Pulse Counter Input 2 (Except FG terminal)
		Ethernet communication	

•Insulation resistance

Between FG terminal (internal circuit) and other circuits	20 MΩ or more (500 V DC)
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• Environmental Conditions

Item	Normal Operating Conditions	Transportation and Storage Conditions	Remarks
Ambient temperature	-20 to 70°C	-25 to 70°C	
Ambient humidity	20 to 90%RH	5 to 95%RH	(no condensation allowed)
Temperature change rate	10°C/h or less	20°C/h or less	
Continuous vibration	Half amplitude: 0.075 mm (frequency : 10 to 57 Hz)		
	Acceleration: 9.8 m/s ² (frequency : 57 to 150 Hz)		
	Sweep cycle count in X, Y, and Z directions: 10 times		
Short-period vibration	14.7 m/s ²		
	15 sec. or less		
Shock	Energized: 98 m/s ² or less Non-energized: 147 m/s ² or less Three times each in X, Y, and Z directions with half-sine shock pulse	When contained in external packing (blue box) 90 cm or less	Impact time 11 ms or less
Magnetic field	400 A/m or less		
Warm-up time	30 minutes or more after the power is turned on		
Toxic gas	Location free of corrosive gases		
Altitude	2000 m or less above sea level		

• Safety and EMC Standards

CE, C-Tick

Safety

IEC61010-1 and EN61010-1.

Installation category	CAT I
Pollution degree	2
Measurement category	I (CAT I)
Rated measurement input voltage	±30 V DC max.
Rated transient overvoltage	1500 V (*)

* This is a reference safety standard value for Measurement Category I of IEC/EN61010-1. This value is not necessarily a guarantee of instrument performance.

EMC

CE marking
EN61326-1 Class A, Table2
EN61326-2-3
EN55011 Class A Group1

C-Tick mark
EN55011 Class A Group1

The instrument continues to operate at a measurement accuracy of within ±10% of the range during testing.

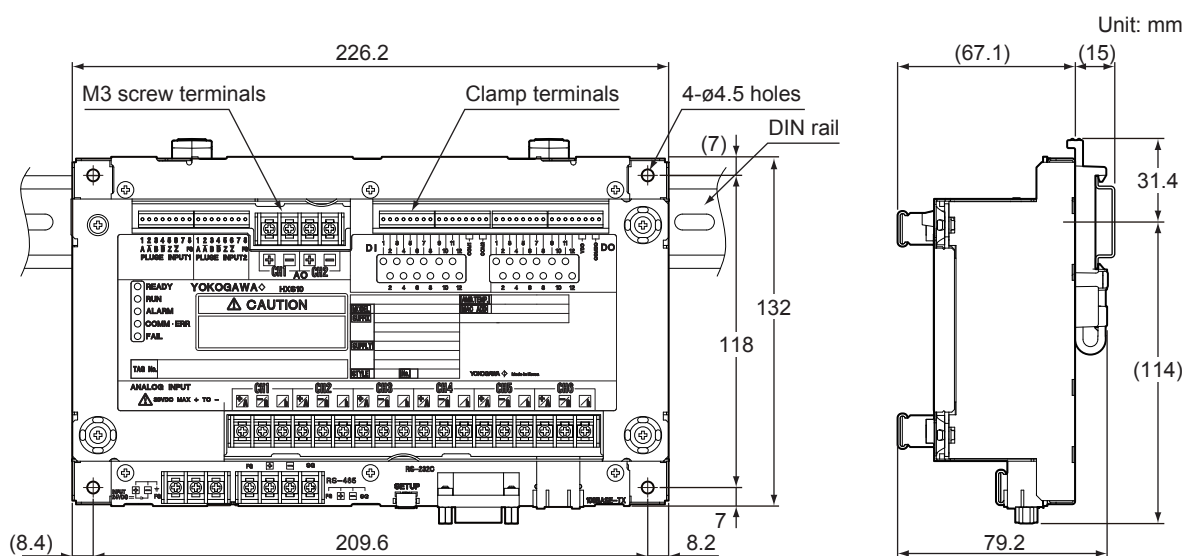
Environmental resistance

Compliant with RoHS, WEEE

• Structure

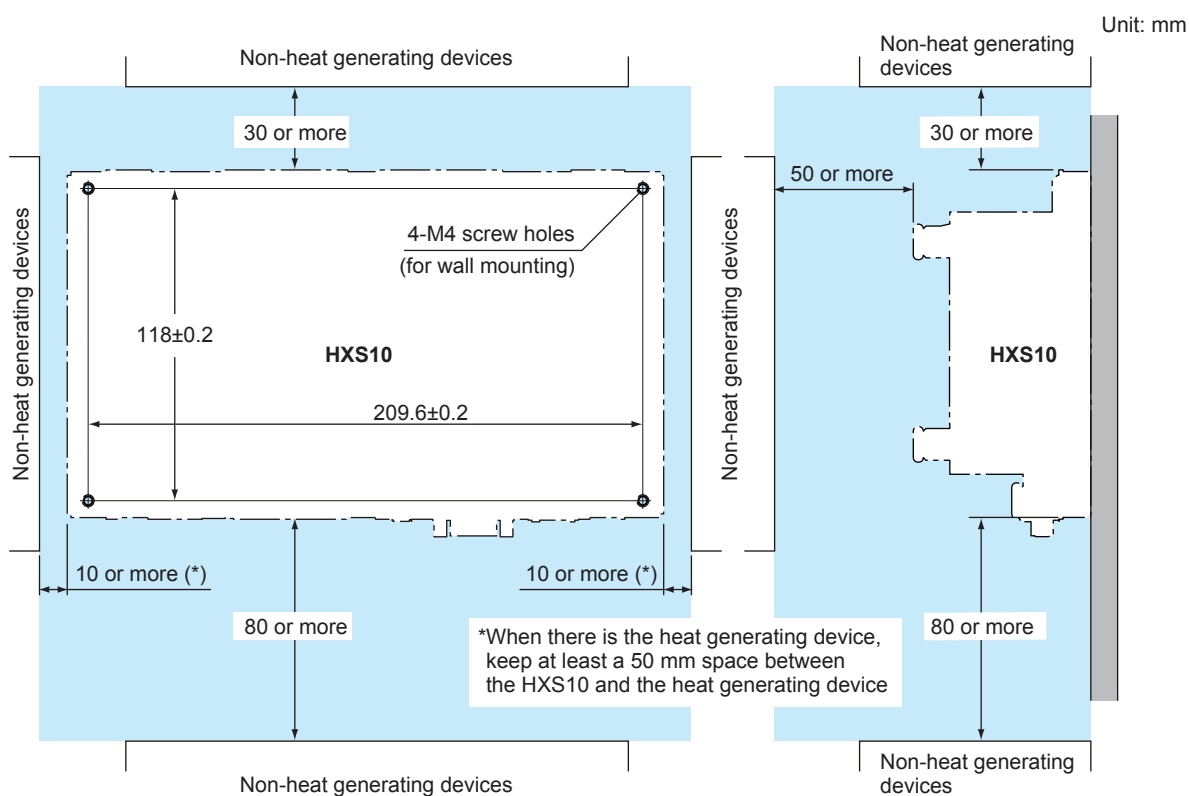
Dust-proof and drip-proof	IP20
Material	Steel plate (Case) Polyacetal resin (DIN rail mounting brackets)
Color	Light gray
Weight	About 1.0 kg
External dimensions (mm)	226×132× (67) (excluding DIN rail mounting brackets)
Installation	Wall mounting or DIN rail mounting For wall mounting, mount the instrument with four M4 screws.
Mounting direction	The product uses air cooling without blower. Install it with the front facing you and in the correct horizontal and vertical directions.

EXTERNAL DIMENSIONS



If not specified, the tolerance is $\pm 3\%$. However, in cases of less than 10 mm, the tolerance is ± 0.3 mm.

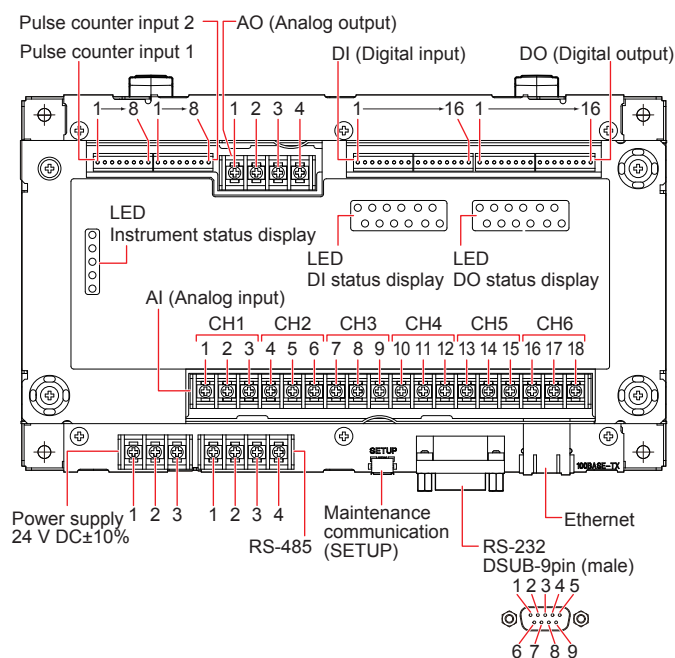
Mounting dimension diagram



This instrument should be well spaced out as shown in the mounting dimensions.
Do not install HXS10 to the location just above the high-heat-generating equipment.

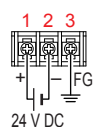
TERMINAL ARRANGEMENT

Terminal Diagram

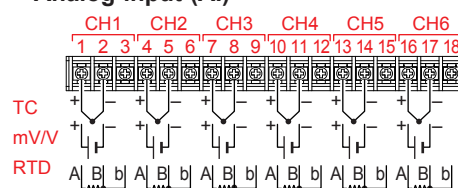


< Power supply >

Terminal No.	Function
1	24 V DC +
2	24 V DC -
3	FG

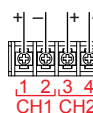


< Analog input (AI) >



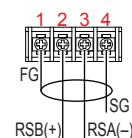
< Analog output (AO) >

Terminal No.	0-20 / 4-20 mA
1	CH1 (+)
2	CH1 (-)
3	CH2 (+)
4	CH2 (-)



< RS-485 >

Terminal No.	Function
1	FG
2	RSB (+)
3	RSA (-)
4	SG



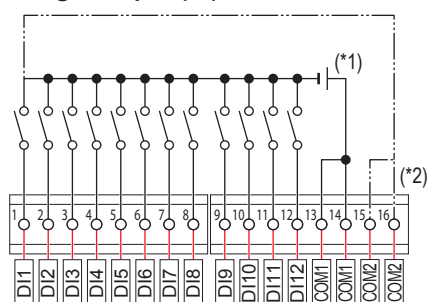
< RS-232 >

Terminal No.	Function
1	
2	RxD
3	TxD
4	
5	SG
6	
7	
8	
9	

Terminal No.	TC	mV / V	RTD
1	CH1 (+)	CH1 (+)	CH1 (A)
2	CH1 (-)	CH1 (-)	CH1 (B)
3			CH1 (b) (*1)
4	CH2 (+)	CH2 (+)	CH2 (A)
5	CH2 (-)	CH2 (-)	CH2 (B)
6			CH2 (b) (*1)
7	CH3 (+)	CH3 (+)	CH3 (A)
8	CH3 (-)	CH3 (-)	CH3 (B)
9			CH3 (b) (*1)
10	CH4 (+)	CH4 (+)	CH4 (A)
11	CH4 (-)	CH4 (-)	CH4 (B)
12			CH4 (b) (*1)
13	CH5 (+)	CH5 (+)	CH5 (A)
14	CH5 (-)	CH5 (-)	CH5 (B)
15			CH5 (b) (*1)
16	CH6 (+)	CH6 (+)	CH6 (A)
17	CH6 (-)	CH6 (-)	CH6 (B)
18			CH6 (b) (*1)

*1: RTD terminal b is shorted internally across all channels.

< Digital input (DI) >

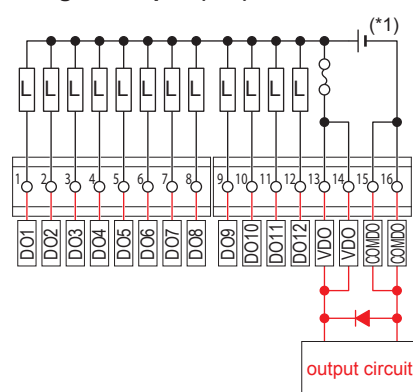


*1: Input power has no polarity.

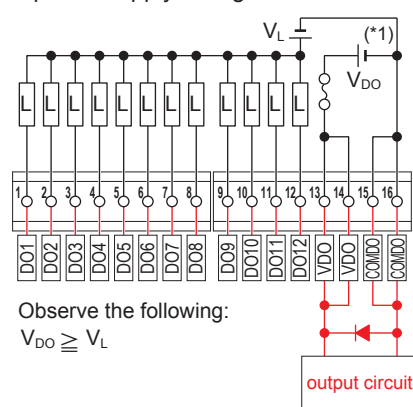
*2: The instrument can operate even if no COM2 is connected.

Terminal No.	Function	Terminal No.	Function
1	DI1	9	DI9
2	DI2	10	DI10
3	DI3	11	DI11
4	DI4	12	DI12
5	DI5	13	COM1 (for DI)
6	DI6	14	COM1 (for DI)
7	DI7	15	COM2 (for DI)
8	DI8	16	COM2 (for DI)

< Digital output (DO) >



- When the load voltage is lower than the external power supply voltage



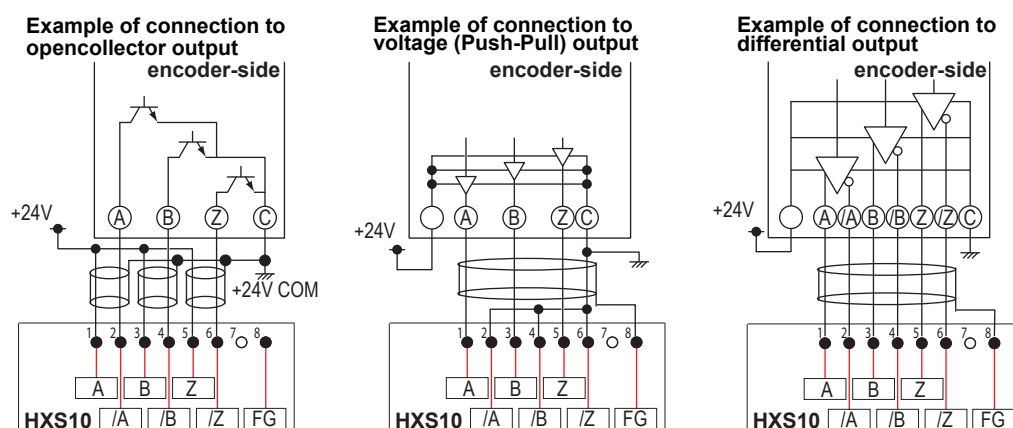
Observe the following:

$$V_{DO} \geq V_L$$

- *1: Ensure the polarity of VDO and COMDO for the wiring.
To protect output circuit in case of reversed wiring, provide fuse to external circuit and reduce incoming electric current to the HXS10 to 100 mA or less.

Terminal No.	Function	Terminal No.	Function
1	DO1	9	DO9
2	DO2	10	DO10
3	DO3	11	DO11
4	DO4	12	DO12
5	DO5	13	VDO
6	DO6	14	VDO
7	DO7	15	COMDO
8	DO8	16	COMDO

< Pulse counter input (Encoder Input) 1, 2 >



* In the case of an open collector type encoder, the calculation may not be normally performed by the capacity coupling between phase A and phase B. When using, connect them separating each phase with shielded wires. The shield must be connected to the common 24 V power supply for encoder input.

Terminal No.	Function		
	Opencollector	Voltage	Differential
1	+24V	A	A
2	A	COMMON	/A
3	+24V	B	B
4	B	COMMON	/B
5	+24V	Z (R)	Z (R)
6	Z	COMMON	/Z (/R)
7			
8		FG	FG

• Others

Item	Specifications
Memory backup	A built-in lithium battery backs up the setup parameters and runs the clock
Lithium battery life	Approximately ten years at room temperature.

MODEL AND SUFFIX CODE

HXS10

Model	Suffix code	Optional suffix code	Description
HXS10			Application specific controller
Analog input	-0		None
	-2		2 channels
	-4		4 channels
	-6		6 channels
Language	-1		Japanese
	-2		English
Application	-01		for Solar tracking
	-02		for Solar tracking (Extended memory)
Fixed code		-00	Always "00"
Options		/AA	Analog output (2ch)
		/C2	RS-232 communication
		/C3	RS-485 communication
		/PC	Pulse counter input (2 channels)

ITEMS TO BE SPECIFIED WHEN ORDERING

Model, suffix code, and optional suffix codes are required.

[HXSS10 Setting Software for HXS10]

GENERAL

HXSS10 is package software to set functions for the HXS10. HXSS10 consists of the following software.

HXS10 Setting Software	This software is connected to one HXS10 with Ethernet or HXSS90 proprietary cable for HXS10 and can perform tasks via a communication network, such as writing and reading HXS10 parameters and user programs, PID tuning, and monitoring user programs.
HXS10 Multi Terminal Setting Software	- This software is connected to multiple HXS10 units (up to 1,000) with Ethernet and can batch write parameters and user programs created with HXS10 Setting Software. - This software also can set the time all at once.

FEATURES

• HXS10 Setting Software

Number of connected units	This software can be connected to and communicate with one HXS10 unit.
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Parameter setting function	This software allows for performing the setting of parameters for the HXS10. The following lists the main parameters. - Control period - Analog input - Input type - Range - Analog output - Output type - Time - Time zone - SNTP setting - DST setting - Solar position calculation - Latitude - Average temperature - Longitude - Average pressure - Modbus master / Modbus client - Period - Register number - Connection destination - Data type - Read or write selection - PID - Setpoint - Integral time - Proportional band - Derivative time - Others - Line segment table - Constant
User program creation function	This function allows for creating user programs for the HXS10. - User program creation method - Function block programming - Text programming
Communication function	This function allows for writing and reading various parameters and user programs to and from the HXS10. (Write can be performed only when the HXS10 is not running)
Tuning function	This function allows for performing adjustment of PID parameters. It allows for setting PID parameters while viewing the PV, SV, and MV trends via communication with the HXS10.
User program monitoring function	This function allows for performing monitoring while communicating with the HXS10. - Monitoring various parameters - Monitoring module input and output values of each module in the function block programming method
File management function	This function allows for saving and reading the setting data to and from a PC. - Parameter - User program
Print function	This function allows for printing parameters and user programs to the printer.
Time setting function	This function allows for setting the time for the HXS10 via a communication network.

• HXS10 Multi Terminal Setting Software

Number of connected units	This software can be connected to and communicate with up to 1,000 HXS10 units.
Transmission of parameters to multi-terminals	This function allows for batch setting parameters created and saved with HXS10 Setting Software to multiple HXS10 units via a communication network.
Transmission of user programs to multi-terminals	This function allows for batch setting user programs created and saved with HXS10 Setting Software to multiple HXS10 units via a communication network.
Transmission of time & date to multi-terminals	This function allows for setting the time for multiple HXS10 units via a communication network all at once.

OPERATING ENVIRONMENT

• PC

Applicable OS	• Windows XP Professional (Service Pack2 or later) (32 bit English/Japanese/Spanish version) • Windows Vista Business (Service Pack1 or later) (32 bit English/Japanese/Spanish version) • Windows 7 Professional (32 bit English/Japanese/Spanish version) Note: Strings in the software are displayed in English in the Spanish version.
Required component	• .NET Framework 3.5 SP1
CPU	• Pentium4 processor, 2.4 GHz or higher recommended • Pentium4 processor, 3.0 GHz or higher recommended for Windows Vista Business/Windows 7 • Pentium D processor, 2.6 GHz or higher recommended • Core 2 Duo processor 1.8 GHz or higher recommended • Pentium Dual-Core processor 1.6 GHz or higher recommended
Main memory capacity	• Windows XP Professional 512 MB or more • Windows Vista Business □ Windows 7 Professional 2 GB or more
Hard Drive Capacity	• Package program storage: 100 MB or more • .NET Framework 3.5 SP1 program storage: 620 MB or more
Display:	• XGA (1024 x 768 pixels or more), 16 bits colors (65,536 colors) or more
Communication port	• USB port (used when performing communication using the maintenance port with HXSS90 proprietary cable for HXS10) • Ethernet port (used when performing communication using the Ethernet port)
CD-ROM Drive	One (required for installation)
Mouse	One (suitable for the OS)

• Printer

Printer	• Printer (suitable for the OS). Paper size: A4
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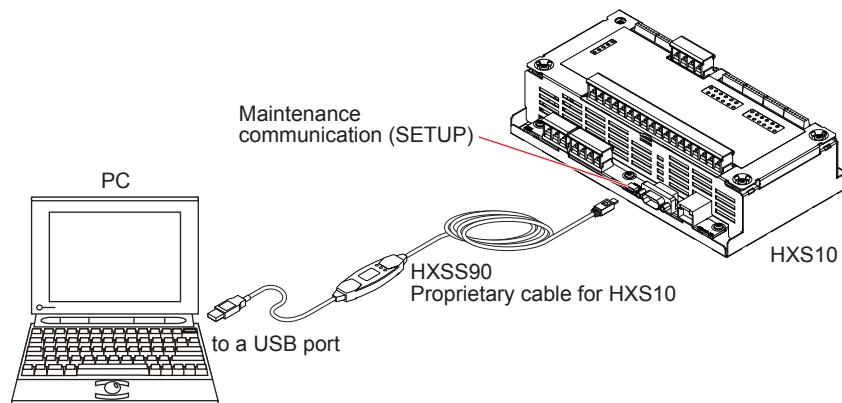
• Connection cable

Connection cable	• Cable compliant with the 10BASE-T/ 100BASE-TX standards (used when performing communication using the Ethernet port) • HXSS90 proprietary cable for HXS10 (used when performing communication using the maintenance port)
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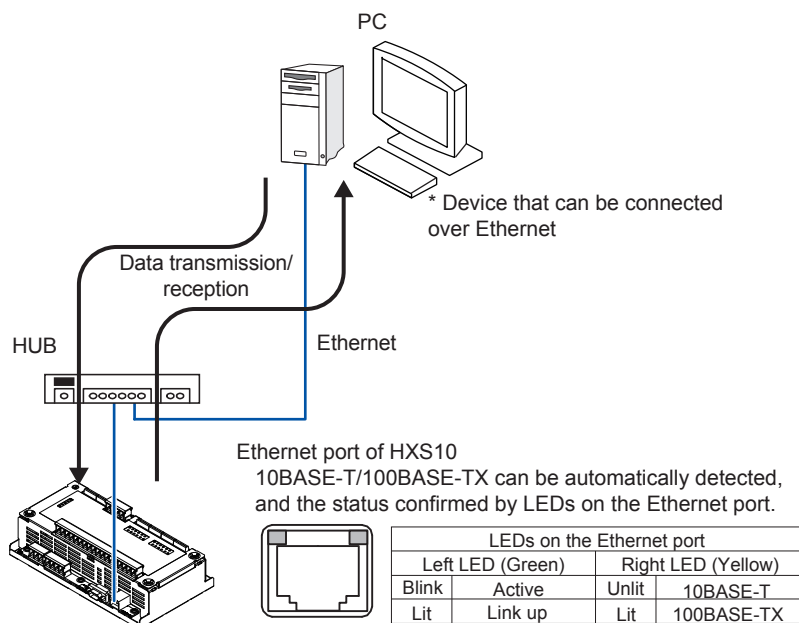
COMMUNICATION CONNECTION METHOD

Communication connection method	Software used	Description
Maintenance Port Connection	HXS10 Setting Software	Can be connected to one HXS10 unit
Ethernet Connection	HXS10 Setting Software	Can be connected to one HXS10 unit
	HXS10 Multi Terminal Setting Software	Can be connected to multiple HXS10 units

Maintenance Port Connection



Ethernet connection



PACKAGE CONTENTS

CD: x1

- HXSS10 Setting software for HXS10
- USB conversion driver
- User's manual

Manuals: x1

- HXSS10/HXS10 Setting Software Installation Manual

Dedicated cable: x1

- HXSS90 Proprietary cable for HXS10

MODEL AND SUFFIX CODE

Model	Suffix code	Description
HXSS10	-0-0	Setting software for HXS10

ITEMS TO BE SPECIFIED WHEN ORDERING

Model and suffix code are required.

[HXSS90 Proprietary Cable for HXS10]

GENERAL

HXSS90 is the Dedicated cable for connecting between PC and Maintenance communication port on HXS10.

• Operating environment

Applicable OS
 Windows XP Professional (Service Pack2 or later) 32 bit
 Windows Vista Business (Service Pack1 or later) 32 bit
 Windows 7 Professional 32 bit

• Interface

Compliant with USB 1.1
 PC-side : USB Series A plug
 HXS10-side : Micro USB
 Cable length : 2.7 m
 Note: Directly insert the USB plug into a USB port on the PC.

• Power supply

Supplied from the USB bus power
 5 V DC, Ave. 30 mA

• Ambient temperature

0 to 50 °C

• Ambient humidity

10 to 90%RH (No condensation)

• Transport and storage conditions

-20 to 65°C, 10 to 90%RH (No condensation)

• Weight

About 90 g

EMC

CE marking

EN61326-1 Class A, Table2
 EN61326-2-3
 EN55011 Class Group1

C-Tick mark

EN55011 Class Group1

MODEL AND SUFFIX CODE

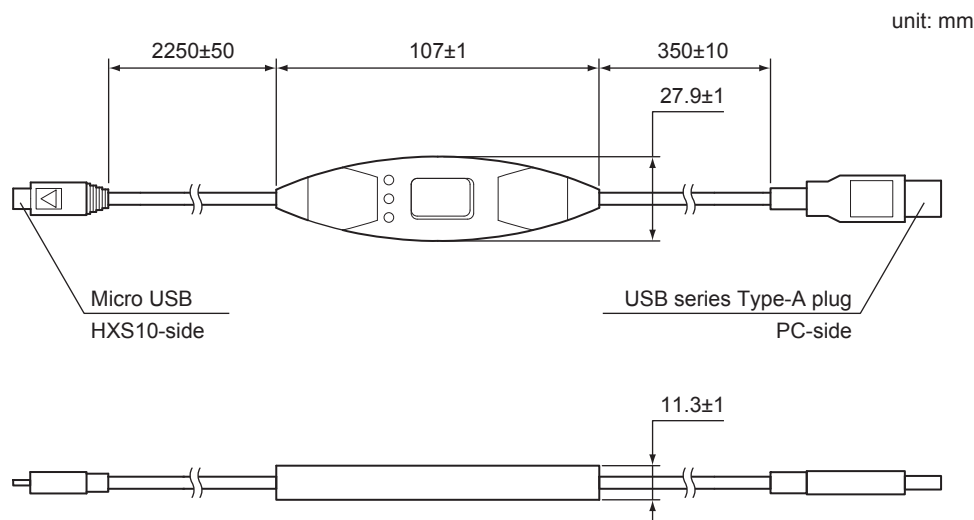
Model	Description
HXSS90	Proprietary cable for HXS10

The dedicated cable for HXSS90/HXS10 is included in the HXSS10/HXS10 Setting Software package.

TERMS TO BE SPECIFIED WHEN ORDERING

Model and suffix code are required.

HXSS90 External Dimensions



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